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Combined reverse osmosis and constant-current operated capacitive deionization system for seawater desalination

Minhas, Muhammad

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Hybrid Reverse Osmosis-Capacitive Deionization versus Two-Stage Reverse Osmosis: A Comparative Analysis

M.B. Minhas, Y.A.C. Jande, W.S. Kim

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Abstract

There is an increase in the use of water purification technologies to produce the purified water from saline water. The desalination process may either involve the use of a single desalination technology, or may include the utilization of multiple desalination methods. In this study, reverse osmosis (RO) is integrated with the constant-current operated capacitive deionization (CCOCD) to desalinate seawater into high-quality ultrapure water, in addition to producing fresh water from the same system. For systems with the same feed concentration and feed flow rates, the RO–CCOCD hybrid system is superior to the RO–CVOCD (CVOCD is the constant voltage operated capacitive deionization) system. The advantages of RO–CCOCD over RO–CVOCD include a longer adsorption time for CDI cells with the same capacitance and spacer volume/dead volume as that of CVOCD, and increased quality of ultrapure water (> 18 MΩ cm) along-with its production. The specific energy consumption for the production of desalted water is generally the same for RO–CCOCD and RO–CVOCD given the same feed concentration and feed flow rate.

Keywords
Reverse osmosis; Capacitive deionization; Seawater desalination; Ultrapure water; Hybrid desalination system